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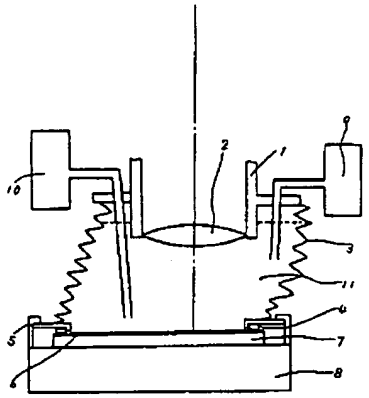
(54) FINE PATTERN TRANSFER APPARATUS

(57) Abstract:

PURPOSE: To improve resolution by making use of a refraction index of liquid, on the occasion of transferring fine pattern using the light, by filling an optical path between the final lens and specimen with a liquid and reducing defocusing of light by refraction.

CONSTITUTION: A bellows 3 is attached to the outside of optical barrel 1, shielding the light progressing space from outside. The interior 11 of bellows 3 is filled with a liquid having a high refraction index and the liquid is sealed by an O ring 4 not to release to the outside. Here, a lens 2 is designed so as to match the refraction index to the specimen 6 with the refraction index of liquid. When refraction index of liquid is considered as n, wavelength becomes 1/n and n times of resolution can be obtained. Here, the specimen is fixed flat by a chuck plate 7 and the O ring is clamped by a tightening jig 5. The specimen can also be moved in the x and y directions by a stage 8. Upon completion of transfer, a purge apparatus 10 operates, exhausting the liquid, and thereby a wafer may be exchanged.



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(54) Title of the Invention: FINE PATTERN TRANSFER APPARATUS

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Specification

1. Title of the Invention:

FINE PATTERN TRANSFER APPARATUS

2. Scope of Patent Claims

(1) A fine pattern transfer apparatus that is an apparatus that transfers a fine pattern onto a sample using light or ultraviolet rays; characterized in that the path of the light between the final lens and the sample is filled with a liquid.

(2) A fine pattern transfer apparatus described in Claim 1; characterized in that it comprises an apparatus that fills the space between the lens and the sample with liquid at high speed or purges it at high speed.

(3) A fine pattern transfer apparatus described in Claim 1; characterized in that it is able to tightly seal a space that includes the path of the light using a bellows and an O ring.

3. Detailed Explanation of the Invention

(Purpose of the Invention)

(Industrial Field of Utilization)

This invention relates to a fine pattern transfer apparatus that forms a sub-micron pattern on a sample such as a wafer, etc.

(Prior Art)

Conventionally, there have been limits due to diffraction in cases where a fine pattern is transferred using light, so the current situation is such that contrivances such as making the aperture larger or using short wavelength light are being adopted, but they cannot be considered adequate.

(Problems to Be Solved by the Invention)

The present invention was made for such circumstances, and its purpose is to provide a fine pattern transfer apparatus that is able to reduce blurring of light due to diffraction.

(Configuration of the Invention)

(Means To Solve Problems)

Conventionally, the fact that high resolution is obtained by filling the space between the objective lens of a microscope and a sample with a liquid such as oil has been known. This principle is applied to steppers and aligners.

What is a problem at this time is that, in contrast with microscopes, the sample is large, the visual field is also large at approximately 10 mm square, and the distance between the sample and the lens is large, so there is a problem in terms of how to retain the liquid between the lens and the sample. In addition, in the case of a stepper, it is necessary to step-and-repeat samples, and countermeasures are necessary for this as well.

In the present invention, diffraction is made smaller using a liquid with a high refractive index, the space through which the light passes is tightly sealed using an O ring and a bellows to make filling with liquid possible, and the bellows is used to create room for the lens and the sample to move.

(Action)

In the present invention, if, for example, a liquid with the refractive index of 1.5 is used, the wavelength becomes 1/1.5, and diffraction becomes 1/1.5, so, for example, if an optical system that has a resolution of 0.5 μms is used, it is possible to increase the resolution to 0.33 μm.

(Embodiments)

The structure of a fine pattern transfer apparatus resulting from an embodiment of the present invention is shown in FIG. 1. A bellows 3 is attached to the outer part of the lens barrel 1 of the optical system, and the space through which the light passes is shielded from the outer part. A liquid with a high refractive index is filled into the inner part 11 of the bellows, and it is sealed with an O ring 4 so that there is no leakage to the outer part. The lens 2 is designed so that the refractive index of the space between it and a sample 6 matches that of the liquid. The sample is secured to a flat by means of a chuck plate 7, and the O ring is held down by a clamping jig 5. The sample can be moved in the x and y directions by means of a stage 8. When transfer is completed, a purge apparatus 10 operates to expel the liquid, and the wafer is replaced. Then, transfer is performed after a liquid supply apparatus 9 operates to cause filling with the liquid.

(Effects of the Invention)

Through the present invention, the following effects are exhibited.

(1) When the refractive index of the liquid is n, an n× resolving power is obtained.

(2) Since sealing with a bellows is performed, movement in the x and y directions is possible.

(3) Since there are apparatuses that purge and supply liquid at high speed, there is no drop in throughput.

4. (Brief Explanation of the Drawings)

FIG. 1 is a cross sectional drawing that shows the principal parts of an embodiment of a transfer apparatus resulting from the present invention.

1 optical lens barrel
2 final lens
3 bellows
4 O ring
5 O ring clamping jig
6 sample wafer
7 chuck plate
8 xy stage
9 liquid supply apparatus
10 liquid purge apparatus

⑲日本国特許庁（JP）　⑪特許出願公開

⑫公開特許公報（A）　昭63－157419

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㊹発明の名称　微細パターン転写装置

㉑特　願　昭61－303987
㉒出　願　昭61(1986)12月22日

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明　細　書

1. 発明の名称

微細パターン転写装置

2. 特許請求の範囲

(1)光あるいは紫外線で試料上に微細パターンを転写する装置において，最終レンズと試料間の光の通路を液体で満したことを特徴とする微細パターン転写装置。

(2)レンズと試料間の空間に液体を高速で充満させあるいは高速でパージさせる装置を備えたことを特徴とする特許請求の範囲第1項記載の微細パターン転写装置。

(3)ベローズ及びOリングで光の通路を含む空間を密閉できることを特徴とする特許請求の範囲第1項記載の微細パターン転写装置。

3. 発明の詳細な説明

〔発明の目的〕

（産業上の利用分野）

この発明はサブミクロンパターンをウェーハ等の試料に形成する微細パターン転写装置に関する。

（従来の技術）

従来，光を用いて微細パターンを転写する場合回折による限界があるため，開口を大きくするとか，短波長の光を用いる等の工夫が行われているが十分とは言えないのが現状である。

（発明が解決しようとする問題点）

本発明はこのような事情に鑑みなされたもので，回折による光のボケを低減した微細パターン転写装置を提供することを目的とする。

〔発明の構成〕

（問題点を解決するための手段）

従来，顕微鏡の対物レンズと試料間にオイル等の液体を満たせば高解像になることは知られている。この原理をステッパーあるいはアライナに応用する。この時問題になるのは，顕微鏡と異なり試料は大きく視野も10㎜角程度と大きく且つ試料とレンズ間の距離が大きいので液体をレンズと試料間に如何にして保持するかが問題となる。さらにステッパーの場合，試料をステップアンドリピートさせる必要がありこの対策も必要である。

本発明では高屈折率の液体を用い回折を小さくし、Oリングとベローズで光の通る空間を密閉し液体を充満可能にし、ベローズでレンズと試料が動く余裕を作った。

（作用）

本発明に於いて、例えば屈折率が1.5の液体を用いれば波長が1／1.5になり、回折が1／1.5になるので、例えば0.5μmの解像度を持つ光学系を用いれば0.33μmに解像度を上げることができる。

（実施例）

本発明の一実施例による微細パターンの転写装置の構造を第1図に示す。光学系の鏡筒1の外部にはベローズ3が取付けられ、光が通る空間と外部は遮断されている。ベローズの内部11には高屈折率の液体が満されていて、Oリング4によって、外部へ漏れないようシールされている。レンズ2は試料6との間の空間の屈折率が液体のそれに合うよう設計されている。試料はチャック板7によってフラットに固定され、Oリングは締め具5で押えられている。試料はステージ8によってx，y方向に移動できる。転写が完了すると、パージ装置10が作動して液体を追出し、ウェーハが交換される。その後液体供給装置9が作動して液体を充満させた後転写が行われる。

〔発明の効果〕

本発明によれば次の効果を奏する。

(1) 液体の屈折率をnとするとn倍の解像力が得られる。

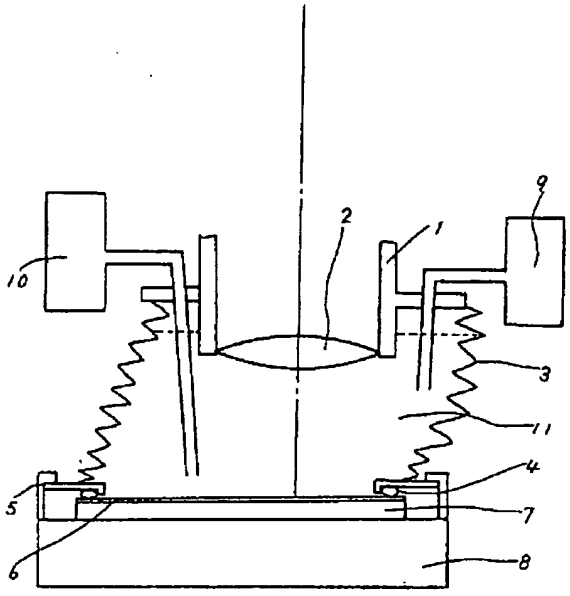
(2) ベローズでシールされているためxy方向に移動が可能である。

(3) 高速で液体をパージしたり、供給したりする装置を持つのでスループットが落ちない。

4. 図面の簡単な説明

第1図は本発明による転写装置の一実施例の主要部を示す断面図である。

1…光学鏡筒、2…最終レンズ、3…ベローズ、4…Oリング、5…Oリング押え金具、6…試料ウェーハ、7…チャック板、8…xyステージ、9…液体供給装置、10…液体パージ装置。



第 1 図